UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/866,319	05/25/2001	Jeffrey B. Johnson	BUR920010011US1	5556

7590 07/14/2004

Steven Fischman, Esq.
Scully, Scott, Murphy & Presser
400 Garden City Plaza
Garded City, NY 11530

EXAMINER	
FARAHANI, DANA	
ART UNIT	**PAPER NUMBER**
2814	

DATE MAILED: 07/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450
www.uspto.gov

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/866,319
Filing Date: May 25, 2001
Appellants: JOHNSON ET AL.

MAILED
JUL 14 2004
GROUP 2800

Leslie S. Szivos
For Appellants

EXAMINER'S ANSWER

This is in response to the appeal brief filed on 4/23/04.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 2-45 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

6,316,818	Marty	11-2001
5,252,841	Wen et al.	10-1993
5,541,444	Ohmi et al.	07-1996
3,924,265	Rodgers	12-1975
6,329,704	Akatsu et al.	12-2001
6,020,245	Sato	02-2000
6,476,446	Ju	11-2002
6,429,489	Botula et al.	8-2002
6,410,984	Triveda et al.	3-2004

(10) Grounds of Rejection

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

2. Claims 4, 6, 8, 12, 13, 15, 16, 19, 23-25, 45, 28, 30, 32, 34-36, 39-41, and 43 are rejected under 35 U.S.C. 102(e) as being anticipated by Marty, hereinafter Marty (U.S. Patent 6,316,818), previously cited.

In regard to claims 4, 45, 24, 28, and 34, Marty discloses in figure 6 a method of fabricating of a bipolar device comprising the steps of providing a structure comprising at least a sub-collector region 2, a collector region 4 and isolation regions 5, the collector region has a deep collector region located therein; forming an n-type dopant region, Selective Implantation Collector, hereinafter SIC, within the collector region , in contact with the deep collector region, and the SIC region has a vertical width sufficiently narrow (the SIC region does not contact collector-base junction) to avoid lowering collector-base breakdown and a dopant high enough (it is more heavily doped

than the collector. See column 4, lines 4 and 5) to restrict base widening when a base-emitter junction is forward biased; and forming a base, Be, and an emitter 11 of figure 5.

In regard to claims 6 and 30, the n-type region dopant is Phosphorus (see column 3, lines 65-67; and column 4, lines 1-5).

In regard to claim 8, the n-type (SIC) region of Marty is formed by ion implantation (and annealing). See column 3, the last two lines; and column 4, lines 1-5.

In regard to claims 12 and 25, the n-type dopant region, SIC, is located adjacent the base collector junction (Be region and 4 of figure 6).

In regard to claims 13 and 32, a lightly doped region of collector 4 (the region above SIC), separates SIC from the base (see figure 6).

In regard to claims15 and 39 Marty discloses the base is a hetero-junction (see column 3, lines 30-39; and column 5, line 31).

In regard to claims 16, 40, and 41, Marty further discloses that the hetero-junction base is SiGe, and has monocrystalline and polycrystalline layers (see column 3, lines 40-45).

In regard to claim 19, Marty discloses portions of the single crystal region of the base are doped to form an extrinSIC base regions (see column 4, the last three lines).

In regard to claim 23, the sub-collector is formed by ion implantation (see column 2, line 47).

In regard to claims 35 and 36, substrate 1 is silicon (see column 2, line 44).

In regard to claim 43, single crystal region 82 contains extrinSIC and intrinSIC base (see column 4, the last three lines).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 2, 3, 14, 22, 26, 27, and 33, are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty.

In regard to claims 2 and 3, Marty discloses the limitations in claims 45, 2, and 3, as discussed above, except for expressly disclosing the vertical width of the SIC region.

Marty, however, discloses that the SIC region reduces the resistance of the collector region. It would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the height of the SIC region in order to adjust the resistance of the collector region. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

In regard to claims 14, 26, 27, and 33, Marty discloses the limitations in claims 45, 13, and 14, as discussed above, except for expressly disclosing the width lengths in the claims. It would have been obvious to one of ordinary skill in the art at the time of the invention to include the range of the region between the n-type region and the base, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

In regard to claim 22, Marty discloses the limitations in claim 45, as discussed above, except for ion implantation being used to form the deep collector. However, Marty teaches that the sub collector layer is formed by ion implantation (see column 2, line 47). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use ion implantation to form the collector region, also, since the method would have been readily available due to its use for the sub collector region, and furthermore, implantation is a widely known and used method for making doped semiconductor regions.

5. Claims 5 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 45 above, and further in view of Wen et al., hereinafter Wen (U.S. Patent 5,252,841), previously cited.

Marty discloses the limitations in claims 45 and 5, as discussed above, except for expressly disclosing the base layer is more heavily doped that the SIC region. Wen discloses at column 6, lines 40-43 that higher base doping results in more base conductivity. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to make the base layer more heavily doped than the SIC region in the collector in order to change the resistivity of those layers.

6. Claims 7 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 6 above, and further in view of Ohmi et al., hereinafter Ohmi (U.S. Patent 5,541,444), previously cited.

Marty discloses the limitations in claims 6 and 7, as discussed above, except for Sb is used as a dopant of the base region.

Ohmi discloses at column 9, lines25-34, that Sb has small diffusion constant, and therefore, is used in bipolar transistors, since small diffusion constant minimize spreading of the impurity during heat-treatment period. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use Sb in Marty's structure, in the base, because of small heat diffusion of the material and in order to minimize spreading of impurity during heat treatment.

7. Claims 9, 10, 37, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 8 above, and further in view of Rodgers (U.S. Patent 3,924,265), previously cited.

Marty discloses the limitations in claims 8-10, as discussed above, except for the specific dopings of the n-type region and the amount of energy for ion implantation.

Rodgers teaches ion implantation energy of 50 KeV to implant boron ions as part of completing a transistor structure. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use this amount of energy, as Rodgers teaches, in order to implant the n-region of Marty's structure.

Although Marty does not disclose the specific doping of the n-region, it is within the level of ordinary skill in the art to choose the desirable doping concentration of the n-region, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch,* 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 8 above, and further in view of Akatsu et al., hereinafter Akatsu (U.S. Patent 6,329,704), previously cited.

Marty discloses the limitations in claims 8-11, as discussed above, except for the annealing being performed at a temperature of about 900 C, or higher, for about 15 seconds or less.

Akatsu discloses annealing is performed with implantation at 900 C to 1050 C from 5-15 seconds to produce the desired resistance at the layer being annealed (see column 5, lines 20-34). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use this temperature and time limit to perform the annealing of Marty's structure in order to make the n-type heavily doped region of Marty's structure with a specific resistivity.

9. Claims 17 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty, as applied to claim 16 above, and further in view of Sato (U.S. Patent 6,020,245), previously cited.

Marty discloses a patterned insulator 9 with an opening to expose a portion of the base region.

Marty does not disclose that the emitter is polysilicon.

Sato discloses that polysilicon emitters are advantageous, because they increase the current amplification factor of the transistor. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a polysilicon emitter in Marty's structure, so the transistor would have a higher current amplification factor.

10. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marty in view of Sato, as applied to claim 17 above, and further in view of Ju (U.S. Patent 6,476,446), previously cited.

Marty discloses the patterned insulators on top the SiGe containing layer are etched (see column 3, lines 54-65).

Marty does not discloses lithography is used also in those layers.

Ju discloses removing of an insulator is etched with conventional lithography techniques. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use lithography with etching to make opening of the insulator layers of Marty's structure, since lithography is commonly used with etching, when one wants to remove insulating, or non-insulating layers of a semiconductor structure.

11. Claims 20 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mary as applied to claim 16 above, and further in view of Botula et al., hereinafter Botula (U.S. Patent 6,429,489), previously cited.

Marty discloses the limitations in claims 16 and 20, as discussed above, except for SiGeC being used instead of SiGe in the base layer.

Botula discloses SiGeC is used in a base of a HBT, wherein the presence of carbon along with Germanium makes the transistor a high frequency threshold transistor. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use SiGeC in the base of Marty's structure in order to make the transistor a high frequency threshold transistor.

12. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 16 above, and further in view of Trivedi et al., hereinafter Trivedi (U.S. Patent 6,410,984), previously cited.

Marty discloses the limitations in claims 16 and 21, as discussed above, except for CVD being used to deposit the SiGe layer.

Trivedi teaches CVD method is used as a method of forming a layer of an interconnect structure. It would have been obvious to one of ordinary skill in the art at the time of the invention to use CVD method to form the SiGe layer, since the CVD method completely covers the layer beneath the deposited layer, and the method is widely used.

(11) Response to Argument

Appellants traverse the examiner's rejection under 35 USC 102 over the Marty reference. Appellants state that Marty fail to disclose an n-type dopant region having a vertical width (W) that is sufficiently narrow to avoid lowering the collector-base breakdown voltage and a dopant concentration sufficiently high to resist base widening when the base-junction is forward biased. Appellants argue that the SIC region in the Marty reference necessarily includes a tail of n-type dopants extending into the base (base shown as B, referring to figure 6 of the reference) and therefore fails to anticipate Appellants' claimed structure, as recited in claim 24, on appeal. Appellants reason that the SIC region is implanted through the base into the collector using a high-diffusivity

dopant and high implant energy resulting in a broad shallow implant having a tail of n-type dopants extending into the base.

Now, referring to figure 1 of the instant application region 18 defined as the region formed over the subcollector region 12, and region 18 has a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward biased (specification, page 6, lines 5-9). Region 18 is a n-type doped region formed above the collector region 16 (of figure 1) and below the base region 22 such that it does not directly contact the base region, as can be seen in the figure. Appellants allege that this feature, namely the disconnection between region 18 and base 22, is absent from the Marty reference, for the reasons discussed above, hence the limitation "...wherein said diffusion has a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward biased" is not anticipated by the Marty reference.

The region shown as SIC in the Marty reference is also an n-type doped region (doped with phosphorus, col. 3, lines 65-67; and col. 4, lines 1-5); it is heavily doped (col. 4, line 4); and it is not in contact with the base layers 80-82, as can be seen in figure 6 of the reference. It is stated in the reference that the SIC region is doped by selective implanting; and, in general, the depth of implantation of ions can be controlled. As noted above, the SIC region is selectively doped (implanted) into the collector 4 of the reference, and obviously in the reference the SIC region meant to be a region doped

deep into the collector, and does not directly contact the base region. Furthermore, Appellants' argument that since in the claimed invention the region 18 is formed into the collector prior to the formation of the base region 26, while in the Marty reference the SIC region formed following the formation of the base does not mean that the SIC region has a tail of n-type dopants that reach the base region, since the depth of the implanted ions can be controlled.

Appellants argue, in response to examiner's rejection of claims 2 and 3 under 35 U.S.C. 103(a) over Marty reference, that it would not have been obvious to one of ordinary skill in the art to adjust the height of the SIC region in the Marty reference, as stated in the rejection. However, the Marty reference discloses that the SIC region is introduced to reduce the collector resistance (col. 4, lines 3 and 4). As stated in the rejection, it would have been obvious to change the height of the SIC region in order to adjust the resistivity of the collector. Different applications of the bipolar device of the Marty reference require a collector resistance that can be adjusted to be suitable for that particular application. This can be achieved by the height of the SIC region being variable, as the reference suggests at column 4, lines 4 and 5.

Appellants state that in conventional semiconductor device, there is a tradeoff between the Kirk effect and breakdown voltage. In the claimed invention, n-type region 18 is doped heavy enough to delay the onset of the Kirk effect, yet has a vertical width narrow enough to avoid creating a high-electric field of sufficient duration to degrade the breakdown voltage of the device. Appellants submit the in the Marty reference, the SIC region is highly doped (col. 4, line 4), but maintain that the over doping of the SIC region

compromises the breakdown voltage of the device, and therefore, the reference fails to disclose the limitation that of the n-type dopant has a vertical width sufficiently narrow to avoid lowering the collector-base breakdown voltage. As discussed above, and as shown in figures 3-6 of the Marty reference, the SIC region does not contact the base regions, shown as B in the figures. Therefore, the SIC region of the Marty reference has the same effect as that of the n-type region 18 of the instant application. The n-type region is above the subcollector region 12, and below the base region 22 (figure 1 of the instant application), and does not contact the base region.

Appellants allege that the secondary references: Wen et al., Ohmi et al., Rodgers, Sato, Ju, Botula et al., Triveda et al., and Akatsu fail to alleviate the deficiency of the Marty reference, namely, the n-type dopant region having a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage. As discussed above, the Marty reference discloses this feature.

In conclusion, the region 18 of the instant application is an n-type region formed deep into the collector region, heavily doped, and does not directly contact the base region. The SIC region of the Marty reference is an n-type region formed deep into the collector, heavily doped, and does not directly contact the base region. Therefore, the later performs the same function as that of the n-type region 18 of the instant application, whereby satisfying the limitation that of a region having a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward biased.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Dana Farahani
July 9, 2004

Conferees
Olik Chaudhuri OC
Wael Fahmy W.F

Steven Fischman, Esq.
Scully, Scott, Murphy & Presser
400 Garden City Plaza
Garded City, NY 11530